THE BRITISH JOURNAL

OF

OPHTHALMOLOGY

MARCH, 1930

COMMUNICATIONS

COLOUR VISION AND ITS ANOMALIES*

BY

SIR JOHN PARSONS

IN allotting to me the subject of Colour Vision, Dr. Wilmer has set me a very difficult task, and it will be one of my objects to prove to you how difficult it is. I regard this as the more necessary because various enthusiasts have propounded theories of colour vision which profess to explain everything, thus resembling quack remedies which cure all ills.

First, then, what is colour? It would seem very easy to answer this question. The sky is blue, grass is green, and strawberries are red. Nobody who speaks the English language will deny the accuracy of these and cognate statements. So that in common everyday parlance we must logically conclude that colour is an attribute of things. But, if so, it is not at all difficult to demonstrate that it is a very variable attribute. In this delightful country of yours you must often have sat out on your verandahs whilst twilight has stolen over the landscape. If you have been able to tear yourselves away from your philosophical meditations to make a few scientific observations you may have noticed that as twilight became deeper the red flowers first ceased to look red and later on the grass and the leaves ceased to look green. The red soon became black, and the green grey. And if you plucked a few leaves and held them close, though you could quite well see their

* An address delivered at the opening of the Wilmer Ophthalmological Institute, at Baltimore, on October 16, 1929.

shapes they still looked a ghostly grey. If you were very observant you might notice that whereas the red geraniums looked much brighter than the green grass in daylight, as twilight advanced the grey grass looked much brighter than the black geraniums. Something very curious had happened to the colours of these objects, so that one might begin to be a little doubtful about colour being a mere attribute of things.

Many years ago, about 1675, Sir Isaac Newton let a small beam of sunlight into a dark room through a hole in the shutter and allowed the beam to fall upon a glass prism. The light which emerged from the prism, when received on a white surface was seen to be spread out into what is now called a spectrum. It had ceased to be white, but showed all the colours of the rainbow. The rays which were on the side of the apex of the prism, and were therefore least refracted, were red; then followed orange, yellow, green, blue and violet. So Newton proved for the first time that white light can be split up into all the colours of the rainbow. So it obviously follows logically that colour is an attribute, not of objects, but of light. We have already had our logic upset once, so perhaps we had better be careful this time. Logic has always been ridiculously over-rated. It was fully developed in Plato's and Aristotle's times, but no great discoveries were made with its aid until it was made subservient to experiment, until in fact induction was combined with deduction.

And we shall find that our logic has again been at fault. For since Newton's time it has been shown that the luminous spectrum is only a very tiny bit of the whole spectrum, which stretches out on each side for distances which have never even yet been determined. What *has* been shown is that exactly the same type of radiation—in the physical and mathematical sense—exists on each side of the luminous spectrum, and that it gives rise on the one side to invisible ultra-violet radiation, X-rays, γ-rays of radium, and so on, whilst on the other side it gives rise to invisible heat radiation and beyond that to the Hertzian waves which are used in wireless telegraphy. If colour is an attribute of radiation why is it limited to an almost insignificant little patch?

Physicists have spent an immense amount of time and trouble on these various forms of radiation. They have made spectra with prisms and also discovered that they can make them with finely ruled so-called diffraction gratings, and it will interest you to know that the finest diffraction gratings were first made in Baltimore by Rowland (1882), who succeeded in ruling gratings with 43,000 lines to the inch.

If one takes a thermopile and passes it along a prismatic spectrum from the violet end towards the red end one finds that the rise in temperature which is thus measured increases as the red end is

approached, and it still goes on increasing beyond the red end. There is no abrupt change at the spot where colour ceases to be visible.

If one allows the spectrum to fall on a photographic plate the silver is deposited least at the red end and most at and beyond the violet end. There is again no abrupt change where the colour ceases to be visible.

If rays from a spectrum are allowed to fall on a frog's eye electrical currents are set up in the retina and optic nerve. Ultra-violet radiation a little way beyond the violet end will not produce any result, because the rays never reach the retina, being absorbed by the cornea and the lens.

So we see that the effect produced by radiation depends not only on the nature of the radiation, but also upon the nature of the receptive medium.

We also learn that when the so-called luminous radiation falls on the retina it sets up electrical currents. Now there is ample evidence to prove that these electrical currents are a concomitant of nervous impulses. In themselves they show a change in the form of energy, and it is a fundamental rule of physics that change of energy occurs only when energy is absorbed by a substance. We may therefore consider it conclusively proved that the luminous spectrum sets up physiological changes in the form of nervous impulses.

When nervous impulses are set up they do something. In many cases they cause changes in the consciousness of the individual. How they do this nobody knows. These effects, when they occur, are called psychological effects.

Hence we learn that colour is not a mere attribute of things, nor of light, but that it also involves physiological impulses and psychological effects. Colour, you see, is becoming rather a complicated business.

Ultimately you will all agree, colour, being an event in perception, which is a fundamental feature of consciousness, is a purely psychological fact. Without consciousness there is no colour. On the other hand, using the term colour in a broad sense, we may say with Clerk-Maxwell (1871) that, " all vision is colour vision, for it is only by observing differences of colour that we distinguish the forms of objects." He was only repeating what had already been said by that extraordinary genius Goethe (1810): " The eye sees no form, inasmuch as light, shade, and colour together constitute that which to our vision distinguishes object from object, and the parts of an object from each other."

Colour vision then is a form of perception, and like all forms of perception it is the ultimate result of physiological impulses set up by physical stimuli. The investigation of colour vision, therefore,

demands a somewhat advanced knowledge of physics, physiology and psychology.

It is obvious that the investigation of the problem can be approached from two sides. We can alter the physical stimuli in various ways and study the psychological results—a method which I have called the synthetic method: or we can take the psychological facts as data and attempt to analyse them—the analytical method. Both have been exhaustively pursued, but as might be expected more fruitful results have been obtained from the former than the latter.

The first great step in the investigation was taken by the physicists, who naturally adopted the first method, sometimes falling into error through ignorance of physiological and psychological factors Newton himself (1704) set the ball rolling by isolating little bits of the spectrum, mixing them together, and observing results. And here it is important to lay stress on the fact that he adopted the best scientific method: for by so doing he was dealing with the purest and simplest stimuli that can be obtained. Many people have fallen into grievous error by their deductions from impure or mixed stimuli, for nearly all the colours of nature and art are impure, in the sense that they are themselves mixed colours. After Newton countless experimenters have confirmed and extended his results, among whom Clerk-Maxwell deserves special mention.

What happens if we mix pure colours? Let us consider a luminous spectrum, such as that produced by white light passed through a glass prism or spectroscope. On the wave-theory of light the various parts can be accurately defined by the wave-lengths of the rays. The limit of the visible spectrum to normal eyes is about 760 $\mu\mu$ at the red end to 396 $\mu\mu$ at the violet end. It will be noticed that as compared with sound waves in air the ether vibrations of the luminous spectrum extend over rather less than one octave. In the solar spectrum there are certain black lines, discovered by Fraunhofer, and caused by the vapour of incandescent metals, which afford the means for very accurately calibrating any spectrum. Of these lines the most important for our purpose are:—lithium, 670 $\mu\mu$ (red), sodium, 589 $\mu\mu$ (orange), and thallium, 530 $\mu\mu$ (green).

Pure colours can be mixed by allowing parts of the spectrum to pass through narrow slits in an opaque screen and focussing the combined rays on the eye or on a white reflecting surface. If we start with two colours from the red end of the spectrum, *e.g.*, 670 $\mu\mu$ (red) and 580 $\mu\mu$ (yellow) it is found that any mixture can be accurately matched with that derived from some spectral colour between those wave-lengths. The exact position, *i.e.*, the wave-length, of this colour depends upon the relative amounts of the two colours in the

mixture. If there is an excess of red the resultant mixture will match a colour nearer the red than the yellow-green. Moreover, the position of the colour will be accurately represented by the mass centre of the weights of the two components, *i.e.*, by the centre of gravity, as Newton showed. All colour sensations in this region are therefore functions of a single variable and can be represented on a straight line.

Complications arise when we pass beyond these limits. If a yellow is mixed with a blue-green the resultant mixture, though resembling a pure intermediate colour, does not match it perfectly. The match is made perfect by adding a certain proportion of white light to the pure spectral intermediate. In others words the mixture is paler, or less saturated, than the spectral match. As the distance between the mixing colours is increased the saturation becomes continuously less, until, finally, at one distance two colours are obtained which, when mixed, yield a sensation of white, free from all traces of colour sensation. Such colours are called *complementary* colours.

There is a range in the green from about 560 $\mu\mu$ to 492 $\mu\mu$ which possesses no spectral complementary. White can only be obtained from green by mixing it with both red and violet, *i.e.*, purple.

The whole gamut of purples is obtained by mixing appropriate quantities of extreme red and violet: they are all functions of a single variable and can be represented on a straight line. Each purple has its complementary in the green zone of the spectrum between 560 $\mu\mu$ and 492 $\mu\mu$.

The experiments on the mixture of pure spectral colours have proved conclusively that, with the qualifications about to be mentioned, every colour sensation can be produced by the mixture of not more than three spectral colours, on the condition that the three colours are so chosen that neither can be obtained by mixture of the other two. The qualifications are:—(1) that a perfect match is only obtained in many cases by adding a certain amount of white light to the comparison colours, *i.e.*, that the mixed colours produce a perfect match as regards hue, but are what is called less saturated; (2) that brown, olive-green, and greys possessing some coloured hue can only be obtained by mixing black with a spectral colour or mixture of colours.

Subject to these qualifications, within a certain average range of intensities, every conceivable light or light mixture gives rise to a sensation which can be accurately matched by the sensation produced by a suitable mixture of only three lights. In other words, from the point of view of physical stimuli *normal colour vision is trichromatic*. It cannot be too dogmatically emphasized that this law is entirely independent of any theory of colour vision. It is a statement of facts derived from logical induction. It is true

that it is the chief source of a theory which has naturally, but somewhat unfortunately, been called the trichromatic theory. It is better to call it the three components theory. Whether this theory will ultimately prove to be an exhaustive explanation of the facts of colour vision or not, those facts upon which it is primarily based are so striking and fundamental that in my opinion no theory is likely to prove valid in which they do not form a predominant characteristic.

Seeing that the range of luminous vibrations extends to approximately one octave it was natural that an explanation of the facts should be sought in some analogy to sound and hearing. All such attempts have egregiously failed and are now discredited. Apart from that, however, just as the organ of Corti is regarded as responding to individual frequencies of vibration, so it is conceivable that the visual mechanism may possess receptor organs responsive to individual ethereal frequencies. Such a mechanism would be extraordinarily complex, and there is no evidence, anatomical or other, that it exists. The trichromatism of normal colour vision, however, simplifies the problem, as was first suggested by Thomas Young (1801). For three receptive organs—Young unfortunately predicated three " nerve fibres "—all of which responded in suitably varying degree to every frequency of the luminous spectrum, would account for all the facts of colour mixture. Three names are outstanding in the history of the three components theory, Helmholtz, Clerk-Maxwell, and Abney. To them we owe the determination of the three hypothetical so-called sensation curves.

There are two methods whereby these curves can be determined. That adopted by Helmholtz (and worked out by his assistant, König) and by Clerk-Maxwell takes colour or hue as the fundamental criterion for matching. That adopted by Abney and his colleagues takes luminosity or brightness as the criterion. This is a valid criterion because it has been shown within the limits of experimental error that the luminosity of the white light formed by the mixture of all the rays of any given spectrum is equivalent to the sum of the luminosities of the individual parts of the same spectrum.

The " sensation curves " as determined by König, with corrections by Exner, are shown in Fig. 1. Those determined by Abney and Watson in Fig. 2. The curves determined by different observers are not strictly comparable unless corrected for the energy distribution of the given spectrum, as was done by König, and by Abney and Watson. Even so, it is much to be desired that they should be re-determined with all the precautions which further experience has indicated. It is hoped that this will be accomplished shortly by a new apparatus devised by Wright,

working for the Physiology of Vision Committee of the Medical Research Council (*Trans. Optical Soc.*, XXIX, 225, 1928).

Seeing that these curves are founded upon the facts of colour mixture they afford a hypothetical explanation of these facts, and

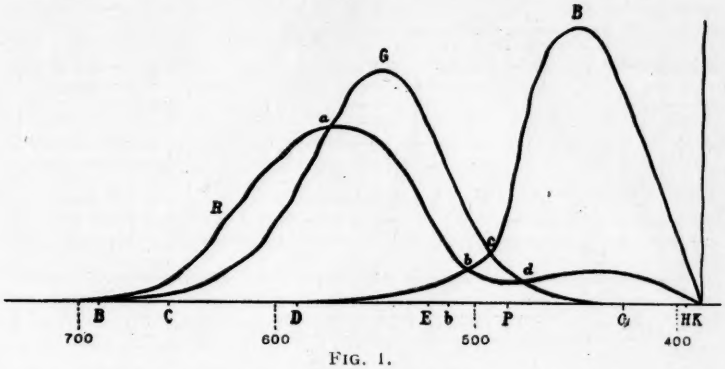

FIG. 1.

R, *G*, and *B*, sensation curves. These are König and Dieterici's curves corrected to new determinations of the points of section, *a*, *b*, *c*, *d*. Abscissae, wave-lengths of the interference spectrum of the arc light; ordinates, abitrary scale (F. Exner.)

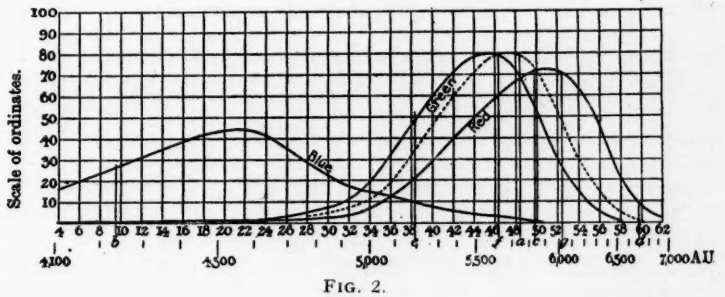

FIG. 2.

Normal sensation curves on equal area scale. (Abney and Watson.)

they point the way towards the explanation of many other obscure points with regard to the spectrum. For example, they indicate quantitatively the degree of unsaturation of spectral colours; for it is only near the extreme ends of the spectrum that the colours are saturated, whereas in the green part they are very unsaturated. Moreover—and this is a point which I wish specially to stress on account of its importance in colour blindness—they give quantitative estimates of the three components to the luminosity of

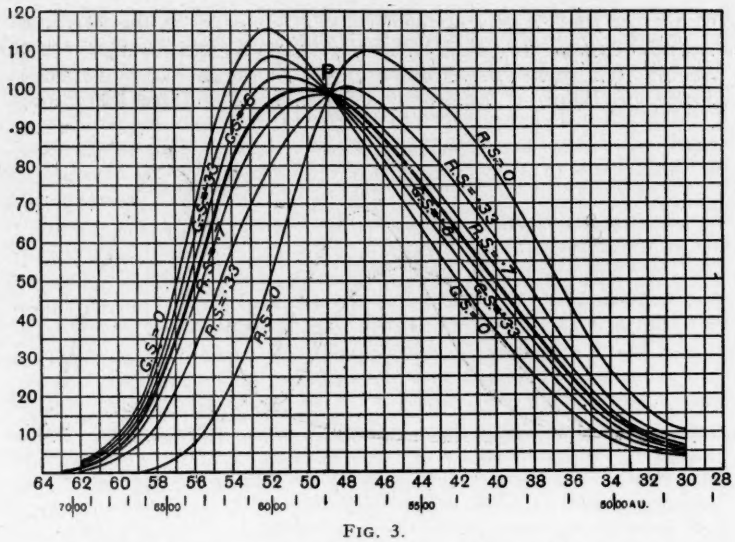

FIG. 3.

Luminosity curves of persons having normal and reduced red and green sensations. Abscissae, wave-lengths of the prismatic spectrum of the arc light; ordinates, arbitrary scale. (Watson.)

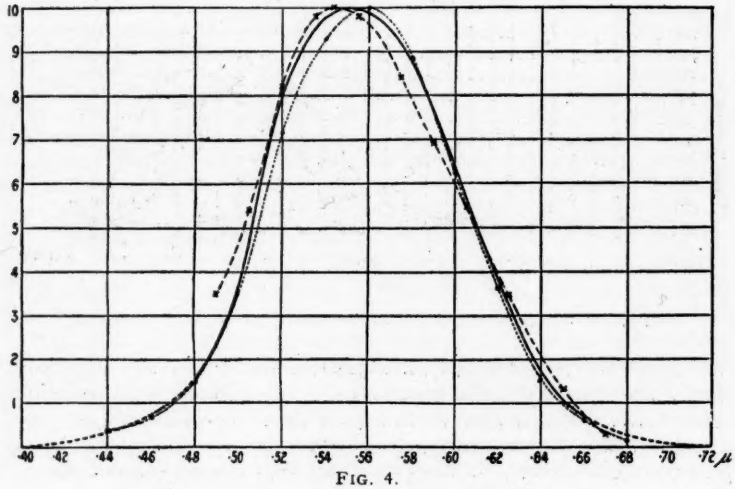

FIG. 4.

———— Average photopic luminosity curve of 18 observers.
– – – – König's photopic luminosity curve (equality of brightness method.)
..... Thürmel's photopic luminosity curve (flicker method.) (Ives.)

individual wave-lengths: added together they determine the form of the curve of distribution of brightness or luminosity in the spectrum (Fig. 3). This agrees with the luminosity curve of the spectrum as determined by ordinary photometric methods (Fig. 4).

Though the three components theory explains the facts of colour mixture, there are other facts of colour vision which it explains with greater difficulty; and indeed Helmholtz wrongly admitted its failure to explain these facts and resorted to psychological explanations.

Let us look at the problem of colour vision from another point of view. Let us regard it merely as a naive phenomenon of consciousness. I look at a spectrum and I see a rainbow of colours. If I analyse my sensations the first thing that strikes me is that there are only four colours in the spectrum which I can regard as utterly dissimilar from each other. All the others appear to me to be mixtures of two of these psychologically fundamental colours. The four colours are red, yellow, green, and blue. Psychologically, as merely naive perceptions, orange is clearly a mixture of red and yellow; on each side of the green are greenish yellow and greenish blue; and beyond the blue is a violet which my experience of purples leads me to suspect is a blue with a tinge of red in it. Many people would say that green is a mixture of yellow and blue, but this is a fallacy founded on the artist's method of obtaining green by mixing yellow and blue pigments. One cannot see yellow and blue in green in the same way that one can see red and yellow in orange.

Now there are many common facts of colour vision which are grouped together under the term contrast, or better, induction. There are two kinds of induction—temporal and spatial: the former is generally called successive contrast, and the latter simultaneous contrast. If I stare at a red patch on a white background for a few seconds and then close my eyes I shall then almost certainly see a greenish patch of the same shape, and this greenish patch will be approximately the complementary colour to the red. If instead of closing my eyes I look at a differently coloured surface, its normal colour will be modified as if by the addition of the complementary colour of the primary stimulus. The obvious inference is that the physiological and psychological conditions of the receptor mechanism have been changed by the primary stimulus in such a way that its excitability has been lowered for a succeeding stimulus of the same nature and enhanced for one of a complementary nature.

Moreover, the change is not confined to the area stimulated: a reciprocal effect is observed on neighbouring areas. A patch of grey paper on a white background looks darker than a patch of the same paper on a black background (Goethe). Similarly a patch

of colour on a grey background induces a complementary response from the surrounding grey.

There seems, therefore, to be some sort of antagonism between the two pairs of psychologically fundamental colours—red and green, and yellow and blue. Such reciprocal actions are common in other nervous physiological phenomena. They led Hering to propound a general physiological theory for them, of which the visual part has survived longest. According to this opponent colours theory green and blue set up assimilative or anabolic changes in the visual apparatus; red and yellow dissimilative or katabolic changes.

The theory, being founded on the facts of induction, explains them at any rate plausibly, but has the grave objection that the trichromatic character of normal vision, as shown by colour mixtures, plays no preponderant rôle. Moreover, it is repugnant to the physiologist's mind to imagine that diametrically opposed metabolic processes should produce phenomena so clearly of the same fundamental character as the perception of, say, red and green.

It has long been known that many men show peculiarities of colour vision distinguishing them from the normal. The colour blindness of the great chemist, John Dalton, first led the attention of scientists to the analysis of the sensations of the colour blind (1798). So great was the stir produced by Dalton's defect that colour blindness was long known as Daltonism.

The vast majority of congenitally colour-blind people manifest their defect most clearly by making mistakes, often grotesque to the normal, in the names which they give to colours in which light of long wave-length predominates. As a result they have difficulty in distinguishing between red and green. Thus, Dalton said that blood looked to him like bottle-green, and grass appeared very little different from red. A laurel leaf was a good match to a stick of red sealing-wax. He was an earnest Quaker, and Quakers object to bright colours. Yet Dalton, having received the degree of D.C.L. at Oxford, wore the scarlet gown for several days, in happy unconsciousness of the effect he produced in the street.

Colour blindness might be regarded as a harmless idiosyncrasy if it were not that red and green are favourite colours for navigation lights and railway signals. It was indeed owing to a serious railway accident which occurred in Norway, and which was suspected of being due to the colour blindness of an engine driver, that Holmgren investigated the subject and devised his wool-test for its discovery. What makes the defect more dangerous is the fact that most colour blind people are quite honestly unaware of it, and attribute their mistakes to the stupidity of other people. Abney, in his Tyndall lectures, records the case of an old

gentleman of 74 who stated that " he was sitting on a black velvet chair, whereas the seat was a deep crimson plush. He laughed at his daughter's description of the mistake he made, and declared he was only colour ignorant, and that she was the one who was colour blind." I, myself, once had a conversation with a highly placed officer in a foreign navy who told me that he was not colour blind, though he admitted he had difficulty in distinguishing strawberries among the leaves of the plant.

Congenital colour blindness affects vision with each eye, and consequently we have no means whatever of knowing what the actual sensations of the colour blind are as compared with the normal sensations. It is true that a number of cases of unilateral congenital colour blindness have been reported in the literature, but it is doubtful if any of them are genuinely congenital, for defects of colour vision are often due to acquired pathological causes.

It follows from this fact that we can place no reliance on the names which these people give to colours. The names they give are those which they have learnt from popular usage and which have arisen as descriptive of normal colour sensations. In every day life the names they give are often correct, though they often exhibit a hesitation which is suggestive to the expert. Owing to the polemics which have centred around the question of colour naming it is necessary to add that colour names are certainly of importance in determining whether a man is dangerous as a navigator or engine driver; for if he calls a red light green, or vice versâ, he is obviously dangerous.

Seeing that we cannot depend upon the accuracy of the terminology of the colour blind we must adopt other means for proving the nature of their abnormality. I have no hesitation in saying that the surest method is that of comparing their matches of spectral colours in various combinations. Only by this method are we quite certain of the exact nature of the stimuli which we are employing to excite their visual sense. For pigments—such as wools, cards, and so on,—and even transparent glasses reflect or transmit such complex radiations that error is likely to arise. At the same time, bad cases can easily be detected by less accurate methods: but it should never be forgotten that partial cases, such as are quite common, may also be dangerous.

When we test a large number of colour blind people—and they are not difficult to find, for at least 4 per cent. of males are badly colour blind—we find that it is not difficult to obtain two quite distinct groups, both of which match reds with greens. But the matches they make are quite different. One group which, if the numbers are large, will be the smaller group, match a slightly bluish-red with a dark green, *e.g.*, scarlet with olive-green: these

are the people who cannot distinguish by colour the difference between cherries or strawberries and their leaves. The other, larger group match a much bluer red with a green which has about the same brightness to the normal, *e.g.*, a pink with a pale green.

The majority of our victims, however, will not make such egregious errors, although most of them will make mistakes which are found to be of the same type. In 1881, the late Lord Rayleigh made the important discovery that many people with apparently normal colour vision require different amounts of red or green in their colour mixtures from the majority. His observations were confirmed by Donders, and have been amply verified. He used as his test the match of the yellow of the sodium line (589$\mu\mu$) with the yellow which is produced by the suitable admixture of lithium red (670 $\mu\mu$) and thallium green (530 $\mu\mu$). Whilst a few of these anomalous people required more red than the normal, most of them required more green. This is the test which is used in Nagel's anomaloscope.

How are all these cases to be explained—or *can* they be explained—on either of the two theories which have been mentioned?

Exhaustive testing of the very bad cases with a large variety of spectral matches has shown that in both groups every spectral colour can be accurately matched by suitable mixtures of only two colours. Their whole gamut of colour sensations can therefore be referred to a function of two variables, and they are therefore called dichromats. They can be explained on the three components theory on the hypothesis that one of the three components is absent. In the smaller group the " red " curve is absent; in the larger group the " green " curve is absent. Hence, though both confuse reds and greens, the former were called " red-blind " and the latter " green-blind." These are abominable terms and have led to endless trouble. Von Kries replaced them by protanopes and deuteranopes respectively; but it is a great pity that Rivers's purely descriptive terms, scoterythrous and photerythrous have not been adopted, because they are free from all theoretical implications, and merely express the fact that the first group see reds much darker than normal people do, whereas the second group see them in nearly the same brightness as normal people.

Hering said that both groups are " red-green blind," and he attributed the differences to differences in the amount of their macular pigmentation. This explanation has been quite conclusively disproved; and so far as I know, no satisfactory explanation on the Hering theory is forthcoming.

The milder cases are obviously trichromats, but they are abnormal and are called anomalous trichromats. They are

explained on the three components theory as due, not to absence of, but to deficient reaction of, one of the components. It is as though two of the sensation curves were normal and the third had all its ordinates reduced in the same proportion. If the " red " curve is

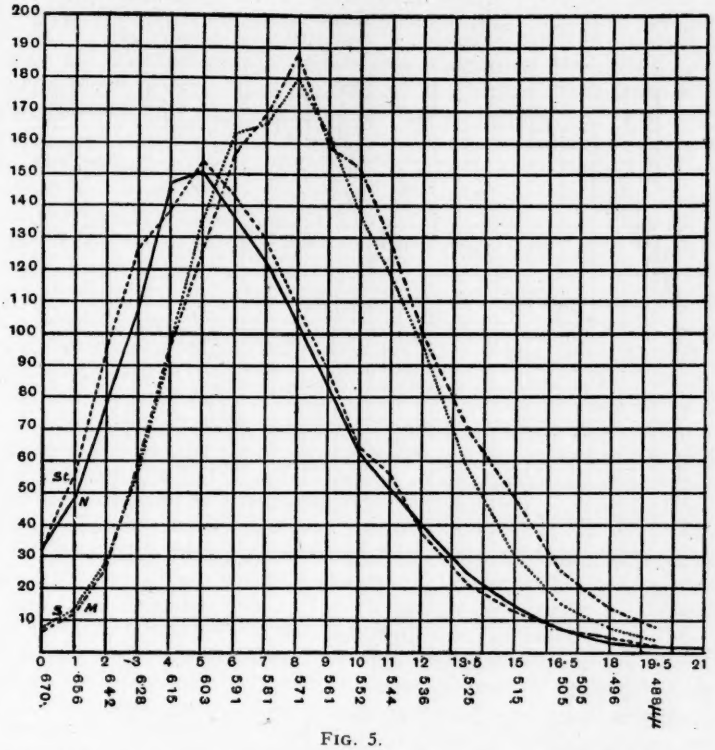

FIG. 5.

Gauging curves for dichromats: "warm" curves. *S* and *M*, two protanopes; *N* and *St*, two deuteranopes. Abscissae, arbitrary scale of prismatic spectrum of gaslight, indicating certain wave lengths; ordinates, arbitrary scale. (v. Kries.)

thus affected they are anomalous protanopes, if the " green " curve, anomalous deuteranopes.

One of the most striking facts about colour blindness was deduced by Seebeck in 1837 from the three components theory and has been proved to be generally correct; *viz.*, that the colour matches made by people of normal colour vision are also valid matches for the colour blind. This fact shows that the colour blind have not got any extra variable which the normal have not got. On

the contrary there is some quality of sensation lacking in them which the normal sighted possess. Colour blindness is in fact a reduction form of normal colour vision, which is exactly what the theoretical explanation suggests.

There are many other features of colour blindness which the theory suggests, and which have been strikingly verified in

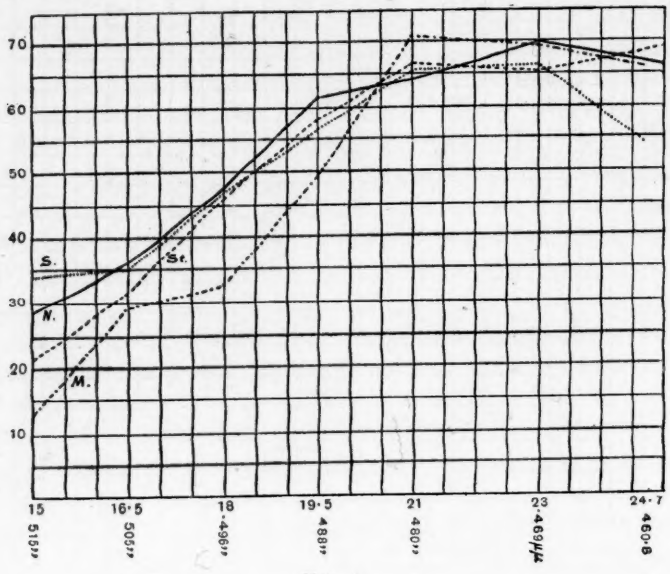

FIG. 6.

Gauging curves for dichromats: "cold" curves. Same observers as in Fig. 5. (v. Kries.)

practice. Thus, if either the "red" or "green" curve were entirely absent it ought to be possible to match every spectral colour by suitable admixture of only two spectral colours if these be chosen sufficiently far apart. This can of course only be expected in very bad cases of colour blindness, but in them it has been found to be true (Figs. 5 and 6). As a matter of fact it will be seen from the curves that from the red end up to about 530 $\mu\mu$ each spectral light can be matched with a red of say, 645 $\mu\mu$, by suitably altering the slit widths, whereas, beyond that point it is necessary to add blue of, say, 460 $\mu\mu$. The "red" curves show distinctly the difference in the two groups, the protanopic maximum being at 571 $\mu\mu$, the deuteranopic at 603 $\mu\mu$. The protanopes therefore require far more red for their matches than do the deuteranopes. This is strikingly brought out by matching

sodium yellow (589 $\mu\mu$) with lithium red (670 $\mu\mu$) when it is found that the protanopes require on an average five times as much red as the deuteranopes (von Kries).

The low stimulus value of red for protanopes accounts for the abnormally low luminosity of the red end of the spectrum to them, and for the " shortening of the red end of the spectrum " in this class of dichromats. The luminosity curves of the two groups are therefore very different from each other and from the normal.

Since white light can be matched by the dichromat with a suitable mixture of two monochromatic lights, and since all spectral colours can be matched by mixing the same two colours in various proportions, it follows that there is some spectral colour which will match white. This point is called the *neutral point* of the dichromatic spectrum. On the three components theory it must fall at that point in the spectrum where the " blue " sensation curve intersects the remaining—" green " *or* " red "—sensation curve; *i.e.*, for protanopes at about 500 $\mu\mu$, for deuteranopes at about 515 $\mu\mu$. These points in the blue-green are not far apart and therefore afford no very crucial test for distinguishing between the two groups: and the point is made still more uncertain by variation of macular pigmentation, which being yellow, absorbs a varying amount of the shorter wave-lengths. The complementary colour to the neutral point must also necessarily match white, and hence there is also a neutral purple. This long established fact has been vaunted as a brilliant new discovery in a recent book on colour vision!

Theoretically there ought to be a third form of colour blindness in which the " blue " sensation curve is suppressed. A few such cases have been recorded. Since the defect causes confusion chiefly at the blue end of the spectrum there is little risk of confusion of red and green lights. Moreover, it is very rare. It is to be noted, however, that the defects of colour discrimination associated with pathological conditions, such as detached retina, retinitis, etc., manifest themselves chiefly at this end of the spectrum.

Finally, we can conceive of two out of the three sensation curves being suppressed. Such people would see the whole spectrum as a monochromatic band, probably resembling the scotopic spectrum seen by normal people with feeble illumination and good dark adaptation. Cases of monochromatic vision certainly occur, but some of them at any rate are better explained on different theoretical grounds.

We shall not, of course, expect the anomalous trichromats to behave like true dichromats. They will not match spectral colours with the admixture of two colours only, nor will they have comparable neutral points. We shall, however, expect them, if the

theoretical explanation is correct, to show gradations as regards the distribution of brightness in the spectrum, etc., between normal colour vision and dichromatism: and such is, indeed, found to be the case. Whether *all* forms of defective colour vision in which reds, yellows, and greens are confused can be explained on this theoretical basis is quite another matter, and there is some reason to think that they cannot.

It has been found that anomalous trichromats differ from the normal in being more dependent upon the physical intensities of the lights and upon the size of the areas of retina stimulated. Moreover, they require longer time to make up their minds as to the colours and are more subject to fatigue. Thus, whereas they make gross mistakes with small sources of light—such as a lantern light at a great distance which is quite discriminable to the normal —they may be quite accurate with larger or brighter sources. They, however, seem frequently to have an enhanced capacity for simultaneous contrast.

The nature of their defect is best discovered by matching tests with spectral colours, and one of the most satisfactory is Lord Rayleigh's original test. Although Nagel's anomaloscope is quite efficient for people accustomed to telescopes and other optical instruments it is not altogether satisfactory for other people. In fact, these spectral tests are much best carried out by direct observation of a small white screen, such as a surface of magnesium or zinc oxide, illuminated by the spectral rays, as for example in Abney's apparatus.

The luminosity curves of the colour blind afford a means of actually measuring the amount of the deficiency in those cases which fall into the ordinary categories, as was shown by Abney and Watson (Fig. 3).

Considering the fact that coloured flags and lights have so long been used for signalling purposes it is remarkable that fifty years elapsed after Dalton before any serious campaign was instituted for the elimination of dangerous colour blind people from occupations entailing their use. Dr. George Wilson, Regius Professor of Technology in the University of Edinburgh, communicated a paper in 1853, and published an important book on the subject in 1855. He seems to have been the first to express the suspicion that fatal disasters had resulted to merchant ships and railway trains from mistakes made by colour-blind men; and he was instrumental in inducing the Great Northern Railway Company to test the candidates for admission to its service before they were chosen. It was not until 1875, that a railway accident at Lagerlunda attracted Holmgren's attention to the danger. His researches led to the invention of his famous wool test, and to the first public discussion of the subject in the United States by Dr.

Joy Jeffries, of Boston, in 1877. Jeffries's book on "Colour-Blindness, its Dangers and its Detection," published in 1879, founded largely on Holmgren's writings, but containing also much original work, forms a landmark in the history of the practice of testing for colour blindness.

Holmgren's wool-test does not quite deserve the obloquy which it has received in some quarters. It is an efficient test for bad cases, but it is true that milder, though still dangerous cases, may escape detection. It is seldom, however, that an expert examiner will not have his suspicions sufficiently aroused by the manner in which the candidate handles the wools to make further tests. Consisting, however, as it does, in the matching of coloured wools it has proved very unpopular with sailors and railway men, who resent a test which savours of effeminacy and seems to have no relation to their actual duties.

A more acceptable test is by means of a lantern showing coloured lights. By its means the practical conditions are more nearly simulated. Lantern tests, however, are at least as liable to lead to mistaken diagnoses unless they are very carefully devised and controlled.

In 1910, as the result of a dispute over a famous case, a Departmental Committee of the Board of Trade was constituted to revise the sight tests for the British Mercantile Marine. That Committee advised the use of a lantern which was constructed according to the specification of three of the members of the Committee. Bearing in mind that the chief guide of the colour blind to the discrimination of red, green, and yellow lights is the relative brightness of these lights *as seen by them*, this lantern uses lights all of which are of the same luminosity. In the hands of the Board of Trade examiners it has proved a very efficient instrument.

Neither Holmgren's wools nor the lantern test is, however, infallible. The decision whether a doubtful case is practically dangerous is often very difficult, and in such cases it cannot be too strongly emphasised that exhaustive tests with spectral colours are absolutely essential.

The possible dangers to travellers by sea and land owing to colour blindness are so obvious that the testing of candidates for the Navy, Mercantile Marine, and Railways is now universal. There is grave reason to fear, however, that the tests usually employed are far from infallible. If this be so it is probable that fatal accidents still arise from this cause. In 1913, the late Mr. Nettleship published a pamphlet "On Cases of Accident to Shipping and on Railways due to Defects of Sight." He collected all the cases he could find in which visual defect was the probable cause of the accident. The list is astonishingly small, and the majority of the cases are inconclusive. It cannot be doubted that

it gives an erroneous, or at any rate an extremely unreliable, estimate of the occurrence and frequency of such accidents. This is due to the facts that in many cases the colour blind navigator or engine driver is himself a victim of the accident, and that, even if he escapes, *he is never re-examined as part of the enquiry into the cause of the accident.*

It is probable, therefore, that an entirely fallacious feeling of security and confidence in the methods of testing is instilled into the public mind. In my opinion, testing for dangerous defects of colour vision in candidates for public services is at present far from satisfactory.

I wish to emphasize most strongly that I am fully aware of the great difficulties which stand in the way of a truly efficient system of tests. I candidly admit that the account which I have given in this address affords but slight indication of the complexities of the subject. The human eye is not a precise physical instrument. On the contrary, it is a highly complex and variable physiological instrument. I have indicated that it is subject to great variations from individual to individual, but it must also be remembered that it varies from moment to moment—that it is subject to adaptation to variations of light stimulation, to temporal variations whereby the responses differ according to previous excitations, to spatial variations whereby the responses differ according to the conditions of excitation of neighbouring retinal areas. There is ample evidence to show that it is a multiplex organ with at least two receptive mechanisms. Facts such as these, which I have not been able to discuss in this address, exasperate the physicists who are accustomed to deal with precise instruments which can at least be expected to exhibit some stability in their performances. The eye probably never behaves twice in exactly the same way. Nevertheless, it does not deserve the opprobrium which Helmholtz once cast upon it.

As you are probably aware colour vision has been a notorious battlefield upon which internecine conflicts have been fought with vigour, and alas, acrimony. It is a feature of clinical medicine that the more obscure the causation of a disease the more numerous and diverse are its vaunted cures. So it is with colour vision, of which it may with much truth be said—*quot homines, tot sententiae*. The theories of colour vision are like the sands upon the sea shore in multitude, and each theorist has his panacea for the infallible detection of dangerous cases of colour blindness. It is not only of the colour blind themselves that Dr. Oliver Wendell Holmes's verses apply:

> " Why should we look our common faith to find,
> Where one in every score is colour-blind?
> If here on earth they know not red from green,
> Will they see better into things unseen?"

REPORT ON A CASE OF A THORN UNDER THE UPPER LID

BY

M. R. SAWHNEY

LAHORE

THE following case is of extraordinary interest and hence worth reporting. It shows what the eye can stand and the natural resistance of the tissues in a child.

A male child aged 5 years, son of a farmer, was brought to the out-patient department of the Mayo Hospital, Lahore, on June 3, 1929. The father of the child complained that the child's left eye had been red for the last five months and had been " getting smaller," by which he meant that the palpebral fissure had been getting narrower. The child at first suffered only from photophobia and lacrymation, but for the last three weeks there had also been a purulent discharge. He casually mentioned that the child said that the trouble started from the day, five months ago, when he fell down whilst running and a thorn went into his eye. The parents had not seen the thorn in the eye at that time or since. The child's eye, however, had been getting worse. It is obvious that the child had at no time suffered from very much pain, otherwise the father would most certainly have brought him to hospital from his village sooner. Pain is the one symptom which does bring ignorant and illiterate patients to the hospital at the earliest opportunity.

On examination, the bulbar conjunctiva was seen to be considerably congested but there was no chemosis. The eyelashes were partly glued together by dried secretion. There was muco-purulent discharge collected in the inner canthus and also between the lashes. Just below and external to the caruncle there was a mass of granulation tissue, about the size of a split pea, sprouting from the conjunctival surface of the lower lid near its inner extremity, and projecting into the palpebral fissure. The palpebral fissure was narrow as the eye was kept half shut. The cornea was quite normal. There was a slight swelling in the lower lid partly in the region of and partly external to the lacrymal sac. On palpation of the swelling there could be felt a hard mass about the size of a small bean. The skin over the swelling was quite free and of normal colour, but the swelling itself could not be moved. On casual examination the case looked like one of chronic dacryocystitis, as there was unilateral conjunctivitis, mucopurulent discharge in the inner angle and a swelling almost in the region of the lacrymal sac. But the swelling was hard and on pressure no

discharge came out of the lower or the upper punctum. Further examination of the eye was impossible without an anaesthetic.

The child was admitted into the hospital. He was anaesthetised with chloroform. After the eye had been washed and all the muco-purulent secretion removed and an eye speculum put in I saw to my surprise a long greyish object projecting out from the mass of granulation tissue on the lower lid and passing under the medial side of the upper lid. I realised that the child was right when he said that a thorn had got into his eye. It was only when the palpebral fissure was widely opened by the speculum that the upper end of the thorn came into view. On catching hold of this object with a pair of forceps it came out quite easily. It was about an inch long and was most certainly a thorn, which had become quite soft on account of its long sojourn in the eye and consequent maceration by the lacrymal fluid. On probing the hole in the mass of granulation tissue through which the thorn projected I found that the probe went into the swelling in the region of the lacrymal sac. No foreign body could be felt in this cavity either with the probe or with a pair of fine forceps. It was obvious that the whole of the thorn had been removed. The swelling was due to the inflammatory reaction of the surrounding tissues due to the presence of the foreign body. The eye was thoroughly washed and the child sent to bed. Unfortunately the father insisted on taking the child away the same day and I saw no more of him. The chief points of interest in the case seem to be:

1. That a thorn about an inch long should have been, for five months, partly projecting under the upper lid without the child having any more trouble than lacrymation and photophobia.
2. The absence of pain.
3. The escape of the cornea from all damage.

My thanks are due to Lt.-Col. A. M. Dick into whose wards the case was admitted.

ANNOTATION

The Unemployable Blind

The Advisory Committee on the Welfare of the Blind, the Chairman of which is Lord Blanesborough, recently presented a report to the Ministry of Health on the subject of the unemployable blind. This report has now been printed and was noticed in *The Times* early in the present year.

On March 31, 1927, the total registered blind population numbered 46,822; in a little more than a year it had increased to 50,771. There had likewise been an increase in the total number of unemployables from 31,667 to 36,485. In 1927 the unemployables formed 67·6 per cent. of the total blind population, while in 1928 the percentage had increased to 71·8.

The framers of this report consider that the large increase in the number of unemployable blind persons is due to increased efficiency in home visiting, and to the extended provision made by local authorities and voluntary agencies for the financial assistance of this class of the population. The report emphasises the fact that no person should be registered as blind except on the strength of the medical evidence.

Returns showed that rather more than one seventh of the unemployable blind were resident in institutions; unemployable blind persons living at home or in lodgings numbered 31,374, of whom 5,780 were married women living with their families. Widows, widowers, married or single persons living alone numbered 4,573. It appears therefore that the great majority of the unemployable blind are living under the aegis of parents, children, relatives, or friends.

Mental defectives numbered 6,565, or 18 per cent. of the total number of unemployable blind. In view of the very limited facilities for the segregation of the mentally defective blind and the possible dangers consequent on unrestricted mixing of mentally defective blind, whether of high degree or only on the border-line, with the general community, the committee wisely advises the authorities concerned that additional accommodation should be provided for this class in the near future.

The committee considers that, in the case of the blind, old-age pensions should begin at the age of forty years instead of at fifty years of age as at present. An income of 25/- a week is considered sufficient by the committee for the adequate maintenance of an adult blind person, living alone, under urban conditions. In rural areas they consider that the minimum should be 18/- a week, and for the more urban areas of the counties from 20/- to 25/- a week.

It will be seen that this report contains much that is of interest to the community, and the committee is to be congratulated upon it. By bringing out the fact of the relatively high percentage of mentally defective persons among the unemployable blind, and by insisting on the need for increased institutional accommodation for these unfortunates, the committee has emphasised a problem of great importance to the welfare of the community.

ABSTRACTS

I.—MUSCLES

(1) **Mackay, R. P. (Chicago).—Ophthalmoplegic migraine.** *Amer. Jl. of Ophthal.*, November, 1929.

(1) **Mackay's** paper opens with the description of a case of ophthalmoplegic migraine in a man aged 28 years. In his first attack at the age of 18 there was no ophthalmoplegia, but a month later he had a second attack with ptosis and inability to move the eye. The subsequent attacks occurred annually, without any residual palsy between them. When seen by Mackay, the headache had disappeared the day before and the patient was found to have a complete third and fourth nerve paralysis with reduction of vision to ability to count fingers. There was also slight weakness of the right facial nerve. All tests including fundus examination were negative. Six weeks later there was partial recovery which became almost complete in a further fortnight. Mackay then gives a survey of the literature from which it appears that although Moebius is usually given credit for the first description of this disease a case was fully described two years previously by an Englishman called Saundby The following characteristics are noted by Mackay. The palsy invariably occurs on the same side as the pain and subsequent attacks usually involve the same side though, occasionally, alternating ophthalmoplegic migraine has been reported. The palsy may vary from a slight weakness to a complete paralysis and the third nerve is the one most commonly involved generally producing both external and internal ophthalmoplegia.

The duration of the paralysis varies from days to months and tends to become greater in subsequent attacks, occasionally becoming permanent. Sometimes instead of paralysis there is a spasm of the affected muscles. Mackay considers that vasomotor changes may be responsible for the condition in some cases, but that in others a localised oedema of the brain may be the aetiological factor. This oedema is probably allergic in origin, as there is evidence that allergy is frequently associated with migraine. The lesion producing the palsy is almost certainly infranuclear, since it is only the third nerve of one side which is paralysed although this nerve receives part of its fibres from the contralateral nucleus. Also other nerves on the same side may be involved as well. In some cases, however, there must also be supranuclear involvement, since symptoms such as aphasia may accompany a right facial palsy.

There is no mention in this paper of the association of ophthalmoplegic migraine with the presence of aneurysms in the circle of Willis.

F. A. W.-N.

(2) **Frenkel, H. (Toulouse) and Calmettes, M. — A case of unilateral ophthalmoplegia interna, the only symptom of cerebral syphilis. (Sur un cas d'Ophtalmoplégie interne monolatérale seule symptome de Syphilis cérébrale.)** *Arch. d'Ophtal.*, September, 1929.

(2) Two recent papers on a similar subject have led **Frenkel** and **Calmettes** to publish a case, under their observation for more than three years, in which a one-sided ophthalmoplegia interna has been and still is the only pathological sign of an affection pronounced syphilitic by examination of the blood and the cerebrospinal fluid. Contrary to what is usual in the early stage of tabes and general paralysis, in which this symptom is a forerunner of more serious developments, some improvement resulted from specific treatment. Although the ophthalmoplegia has not been cured, it has not been followed by any other manifestation of disease in either the nervous or the somatic system.

The published clinical record of this case is very full and detailed. Briefly, it is that of a female, aged 35 years; twice married, one child by each husband, one living and healthy, the other dead at two months of gastro-enteritis. Incidentally the second husband had a Wassermann blood test in 1922 with a negative result. The first complaint, in January, 1926, was of severe pain in the right frontal and periorbital region lasting for several days, after which she noticed that she had difficulty in reading binocularly, and that she could not read at all with the right eye alone. She was examined on February 9, when, excluding the ocular disturbance, nothing abnormal was discovered. The left eye had normal vision and an amplitude of accommodation of 6·5D.: all reflexes normal. The right eye had full distant vision with +0·5D.sph. but required +3·5D. to read 1J. at 33 cm. Pupil 7 mm., all reflexes abolished. T.n., fundus normal. Suspicion of atropine mydriasis was entertained; eight days later the condition was unchanged.

A Wassermann blood test on February 19 was strongly positive: lumbar puncture one week later furnished a limpid fluid, leucocytosis 10·5 to a cubic mm., Wassermann reaction strongly positive.

Antisyphilitic treatment was adopted and was followed by diminution of the mydriasis so that by April 2 the pupils were equal.

In June, 1929, the right pupil was again larger than the left,

under all conditions of illumination; the amplitude of accommodation was 5D. in each eye. Wassermann test gave a negative reaction, but a few weeks later after two injections of acetylarsan it became positive again.

The dissociation of intrinsic and extrinsic paralyses of the third nerve has been explained by the origin and distribution of the blood vessels supplying the nuclei of origin. Shimamura's researches seem to show that in the region of these nuclei there are two blood streams, one coming from the internal carotid artery, the other from the vertebral; moreover the vessels run from the base of the skull almost vertically towards the nuclei; these vessels are without exception terminal arteries.

D'Astros, from his researches, believes that the blood supply of the superior and the inferior portions of the third nerve nuclei is derived from different arterial branches.

These anatomical statements permit the suggestion that ophthalmoplegia interna is due to lesions in the arterioles destined for the anterior group of cells of the third pair, in which is situated the nucleus of the sphincter pupillae and musculus ciliaris. The authors express their surprise at the number of published reports they discovered of isolated ophthalmoplegia in young subjects and in hereditary syphilis, and conclude that the condition is less uncommon than is generally supposed.

Apart from syphilis isolated ophthalmoplegia interna appears to be extremely uncommon. Frenkel and Calmettes give a few references but express the opinion that most of the cases are open to doubt. There is, of course, a small group of cases of traumatic origin. A bibliography of 21 references adds much to the value and interest of this paper.

Favory.—A propos d'un cas d'ophtalmoplégie intrinsèque isolée. *Arch. d'Ophtal.*, May, 1929, and *Brit. Jl. of Ophthal.*, 1929.

Guillain and Barre.—Signe d'Argyll Robertson, unique manifestation apparente d'une syphilis nerveuse. *Rev. Neurologie*, 1916.

J. B. LAWFORD.

(3) **Bettremieux (Paris). — The classification of strabismus.** (**Classification des strabismes.**) *La Clin. Ophtal.*, February, 1928.

(3) **Bettremieux** insists that the failure to cure strabismus is due largely to the fear of over-correction if the operation is performed in early childhood, and consequently to the delay in operating. He asserts that all such fear is unnecessary if the operation be confined to the non-deviated eye.

ERNEST THOMSON.

(4) **Wilde, Major A. (San Antonio, Texas).—Congenital absence of abduction.** *Amer. Jl. of Ophthal.*, October, 1928.

(4) **Wilde's** case was seen by him at the age of 9 years, the squint having been noticed first by the parents at the age of 4. The eyes were parallel when looking straight ahead and the vision of each was normal. Convergence was also normal, but on attempting to look to the right, the left eye was strongly adducted without any corresponding abduction in the right eye and the reverse occurred on attempting to look to the left. The patient was unconscious of any diplopia and no operation was advised as, in all probability, there was complete absence of both external recti. In reviewing the literature, the author notes that 54 cases have been recorded. An account of them by Duane will be found in the *Arch. of Ophthal.*, Vol. XXXIV, No. 2.

F. A. W.-N.

(5) **Liebermann, L. V.—On advancement of muscle. (Ueber Muskelvorlagerung.)** *Zeitschr. f. Augenheilk.*, Bd. LXVI, S. 209, 1928.

(5) **Liebermann** holds that in the treatment of concomitant squint, tenotomy is an operation that can be justified on neither operative grounds, nor functional sequelae. If during the operation the fascial attachments of the internal rectus are left undisturbed, the operative result is poor; on the other hand, if the muscle is completely divided a state of affairs simulating paralysis of the muscle is produced Should the operation have achieved its results in making the eyes parallel, this may have to be paid for by an insufficiency of convergence, even though there is no manifest divergence. These considerations apply equally whether the tenotomy be the only operation, the main one, or merely subsidiary to advancement.

Advancement of the external rectus is the operation to which Liebermann confines himself. That the results in most hands are insufficient is due, in his opinion, to faulty technique, following upon the failure to recognise what is happening to the sutures and the muscles in the days subsequent to operation. The author holds that not only is there a " primary cutting through " of the suture along the muscle-fibres at the time of the operation, but also a secondary effect of the same type owing to pressure necrosis of the muscle-fibres occasioned by the sutures. When it is also taken into consideration that this " secondary cutting through " may occur in the anchorage at the sclera, it becomes clear why there is often a marked diminution of the immediate operative result in the days following the operation. It is the failure to recognise the unavoidable mechanical effects of pressure necrosis before complete healing has taken place that leads to unsatisfactory results.

In performing an advancement, the aim should therefore be to minimise the tension of the sutures. The introduction of multiple sutures and anchorage points at the sclera would tend to distribute the tension, and thus minimise the pressure necrosis at any particular spot. But a better method is to introduce the sutures in such a way that one of them should be entirely relaxed, and only become taut when the suture that has been bearing all the tension has cut through after a few days. Liebermann achieves this result by introducing two sutures placed at right angles to the muscle-fibres, one being placed some little distance behind the other. These are then secured to the sclera in such a way that the more anterior suture is somewhat relaxed; this anterior suture will therefore only come into play when the posterior has cut through. The actual type of suture Liebermann prefers is Meller's "whipstitch."

The results of this procedure seem to be highly satisfactory in Liebermann's hands. Of 35 cases of squint, with an average angle of 35·8°, the operation achieved an average reduction of 27·2°. In the hands of most operators advancement of the external rectus does not give a result approaching this; for one of his cases the author achieved the reduction of an angle of 50°.

In those cases where in spite of advancement of the external rectus there is still left a squint of an angle of more than 10°, Liebermann advises advancement of the other external rectus. Only faulty technique will leave a residual angle of squint after bilateral advancement: for such cases partial tenotomy of the internal rectus will have to be considered.

ARNOLD SORSBY.

II.—THERAPEUTICS

(1) **Chen, K. K. and Poth, E. J. (Baltimore).—Ephedrin as a mydriatic in Caucasians.** *Amer. Jl. Med. Sc.*, Vol.CLXXVIII, p. 203, 1929.

Orr, H. Campbell (Wolverhampton).—Ephedrine in ophthalmology. *Practitioner*, Vol. CXXII, p. 262, 1929.

(1) Ephedrine is an alkaloid, first isolated in 1887 from a plant *ma huang*, which is reputed to have been used for medical purposes in China for about 5,000 years. Like adrenalin, to which it is similar in action, though to a milder degree, it is capable of producing mydriasis, as was first demonstrated in the year the alkaloid was isolated, and recently several attempts have been made to re-introduce it to ophthalmic practice.

Chen and **Poth** recommend it for exploration of the fundus on account of its rapid action, the absence of cycloplegia, the short duration of the mydriasis and its harmlessness. In 21 normal eyes of white people a 10 per cent. solution instilled in the conjunctiva gave rise to an average dilatation of the pupil by 2 mm. within 15 to 30 minutes; the maximum effect becomes apparent within 30 to 60 minutes. The dilated pupil does, however, react somewhat to light, though the light reflex can be abolished by the addition of 0·1 per cent. homatropine or 1 per cent. euphthalmine. The combination was found satisfactory for mydriasis and was easily counteracted by pilocarpine. The effect on accommodation is almost negligible; it is distinctly less than that of euphthalmine, subjects being able to read test type No. 2 at 25 to 30 cm. distance. On the normal eye there is no effect on the intra-ocular pressure, though a case is reported in the literature in which ephedrine precipitated an attack of acute glaucoma.

These findings worked out in a pharmacological laboratory find support on the clinical side in the paper by **Campbell Orr.** Orr employs solutions of only 1 or 2 per cent. Mydriasis is complete in 15 to 30 minutes, varying with the age of the patient, the state of congestion of the eye, the presence of synechiae and the amount of pigment. It is sometimes of value in iritis in reinforcing atropine to break down synechiae; this is especially the case in post-operative iritis. Of particular interest is Orr's finding that in 50 glaucomatous eyes in which mydriasis was produced by a 2 per cent. solution, no rise of tension was recorded, and in 12 a slight fall was noticed. Ephedrine will produce mydriasis in the glaucomatous eye which is under the influence of eserine, and is in turn overcome by pilocarpine or eserine, miosis being obtained in 5 to 10 minutes.

For ophthalmoscopic examination ephedrine is thus superior to homatropine in not causing a rise in tension and in not affecting accommodation; its superiority over euphthalmine lies in the fact that its effect on accommodation is distinctly less; and finally, unlike cocaine, it does not damage corneal epithelium, or produce corneal anaesthesia.

ARNOLD SORSBY.

(2) **Marchesani, O. (Innsbruck).—Contribution to the non-specific or fever-therapy of keratitis parenchymatosa. (Beitrag zur imspezifischen oder Fieber-therapie der Keratitis parenchymatosa.)** *Arch. f. Augenheilk.*, Bd. XCIX, 1928.

(2) In this paper **Marchesani** cites 15 cases of interstitial keratitis treated with intravenous injections of Besredka's polyvalent typhus vaccine combined with neosalvarsan in the same

syringe. Simultaneously the usual local treatment of the eye and the mercury cure were employed. The vaccine used is the one put on the market by the Serotherapeutic Institute of Vienna. The injections were given about every third day and in each case an attempt was made to produce 10 reactions in the form of rises of temperature above 39° C. The doses of the vaccine were regulated by the reaction—local and general—of the patient.

By this means Marchesani believes that the slow dragging course of the disease is changed into an acute one leading to rapid vascularisation and clearing of the cornea.

In a footnote Marchesani refers to Wick's favourable report of non-specific therapy in general (*Arch. f. Ophthal.*, Bd. CXVIII, p. 221) and to Kuborn's experience of malaria therapy in particular (*Zeitschr. f. Augenheilk.*, Bd. LXII, p. 168), in interstitial keratitis.

D. V. GIRI.

(3) **Aubaret, E.—The aetiology and treatment of blepharitis. (Etiologie et traitement de blépharites.)** Soc. française d'Ophtal., 1929.

(3) A treatise on this subject by **Professor Aubaret** is published by the Société française d'Ophtalmologie for 1929. It is one hundred and twenty-seven pages in length, and includes a considerable bibliography from 1905 to 1929. A history of the condition—anatomical and embryological—and a full aetiology are included. The following abstract covers the treatment recommended.

I. Hygienic or Prophylactic

(1) *Local.*—Cleanliness of the eyelids, removal of dust, secretion, or crusts. Avoidance of exposure to excessive heat or cold, to smoky or stuffy atmosphere or irritating vapours, to crowded places, cafés, theatres, cabarets, etc. Avoidance of bright light, natural or artificial, and the use of protective tinted glasses—smoked, Fiuezal, umbral, etc. Excessive dryness of the air as from stoves and central heating, should be avoided by frequent airing of rooms. An atmosphere which is moist and cold, as in fogs, often irritates sensitive eyelids. Wind and dust particularly are to be avoided by means of sufficiently closed goggles in motoring. Late evenings at balls and receptions may need to be avoided, and work late into the night if this causes obvious ocular fatigue. Especially is fine work such as drawing, engraving or fine needlework liable to cause irritation and particularly where the lighting is insufficient. For the latter reason errors of refraction should be carefully corrected. Cosmetic pencils

containing lamp black are not particularly irritating, but Kohl and other preparations containing oriental perfumed essences if introduced into the eye cause irritation. Patients affected with chronic conjunctivitis, epiphora, etc., are liable to increase their discomfort by rubbing the eyes with fingers, handkerchiefs or cloths not always clean. In small children this is sometimes only to be avoided by enclosing the elbows in cardboard tubes to prevent the hands from touching the eyes.

(2) *General prophylactic treatment.*—According to circumstances and the severity of the case, a stay in the country, in the mountains or at the seaside may be advised. Apart from the above, the following are recommended in all cases:—well-aired rooms, physical exercises, out-door games, hydrotherapy, baths, early bed-time and early rising; avoidance of banquets, balls and receptions. In the case of infants, adjustment of the milk diet is necessary, and in older children of the quality and quantity of food and the regularity of mealtimes with the prohibition of food between meals. For adults in addition to a reasonable diet, sufficient mastication and freedom from hurry are desirable, and avoidance of indigestible or rich foods and spices and excess of condiments. Moderation in the use of tea, coffee, alcohol and tobacco should be enjoined.

II. Local Treatment

(1) *Therapeutic measures common to all types of blepharitis.*

(*a*) Lotions, compresses. The patient may be instructed to find out for himself the temperature of any lotion at which he finds its use most satisfactory in effect. The following may be used: infusions of camomile, " mélitot," plantain, fennel, elder, mallow, plain boiled water, or boiled water with a few drops of camphorated alcohol, eau de Cologne or tincture of iodine; boric acid, sodium borate or sodium bicarbonate solutions are generally quite free from danger of irritation, as is naturally also normal saline solution. For simple non-infected blepharitis, normal saline or sodium borate lotion are preferable. In infected cases, solutions of permanganate (1 in 4,000), of cyanide of mercury of the same strength, or of resorcin (2 in 500) are used for bathing or compress. In cases in which even mildly antiseptic lotions cause irritation, oily liquids are used for the removal of crusts of dried secretion—sterile liquid paraffin, olive oil, almond oil or cod liver oil. In some such cases poultices of starch or linseed meal are still less irritant, or even antiphlogistine (glycerine, kaolin, boric acid, salicylic acid, oil of gaultheria, of peppermint and of eucalyptus). A dressing is placed between the antiphlogistine and the skin.

(*b*) Applications, drops and ointments. The application to the

ulcerative form of blepharitis of 1 per cent. silver nitrate solution, of picric acid, colloidal turpentine, 1 per cent. resorcin, or of solution of sulphate of copper or zinc sulphate is often of advantage. Compresses of solution of resorcin (1 in 500) or of ichthyol (1 per cent.), lotions of zinc sulphate (1 in 200) or sodium borate (3 per cent.) may be used frequently by the patient. Drops of 10 per cent. protargol, 5 per cent. argyrol, vitargyl, collargol or electrargol may be applied by means of a tampon of sterile wool to the lid margin with gentle friction. After such vigorous treatment, it is usually necessary either to cover the eyes for a time, or to apply an ointment such as boric vaseline, ointment of zinc oxide or of zinc and ichthyol.

(*c*) Massage and expression of the sebaceous and serous glands of the eyelids by finger and thumb or by Knapp's roller forceps is of importance for the removal of unhealthy secretion. This procedure, however, cannot completely free the lash follicles of foreign matter or infected material, and recourse must sometimes be had to the next.

(*d*) Epilation. In cases of folliculitis, one or more lashes should be removed early. In intractable cases of infected blepharitis, removal of all the lashes, after instillation of cocaine or injection of novocaine, is effective by allowing the entrance of solution or ointments into the follicles. Cuénod is quoted as recommending the careful application of a solution of iodine in acetone to the lid margins after total epilation, and then of a glycerine dressing for twenty-four hours.

(*e*) Physico-therapy. Every method of treatment has been used, with more or less success in some cases, including hydrotherapy, vaporization, steam or hot air baths, diathermy, ionisation, ultra-violet light, X-rays and electrotherapy.

Treatment of Different Types (see tables)

General treatment of blepharitis patients.—These may be grouped into: (1) the scrofulous, anaemic, rheumatic, diabetic and gouty; (2) those with nutritional and endocrine insufficiencies; (3) those requiring specific, antitoxic or vaccine treatment. Various methods of treatment for patients of group (1) are required. Reference may be made to one especial fact, namely that certain cases of blepharitis, as of eczema, show evidence of anaphylaxis or allergy to certain substances. Briefly the methods of desensitisation available are injection of 5 per cent. sodium thiosulphate, 0·9 per cent. sodium chloride or 1 in 30 sodium carbonate solution, or the ingestion of minute quantities of anaphylactic substances or of 0·20 centigrammes of polyvalent peptone. Intradermic injection of 1/10 to 3/10 c.c. of peptone (Witte) may be used.

Eczematous.	Oily seborrhoeic.	Dry seborrhoeic and scaly.	Ciliary and Follicular.
Remove local causes of irritation (atropine, etc.) *For symptoms—* Adrenalin 30 drops Coc. hydrochl. 0·25 gm. Subnitrate of bismuth 2·00 gm. Vaseline 15·00 gm. Zinc sulphate Argyrol Ung. ichthyol zinc ox. Ung. hydrarg. ammon. 1·5% Ung. hydrarg. ox. flav. 2·3% Ung. hydrarg. ox. flav. 1·5% *Dry eczema—* Rice or starch powder *Moist.* Lassar paste modified— Ac. salicyl. 0·5 gm. Ox. zinc. 5·0 gm. Starch 5·0 gm. Vaseline 10·0 gm. *Itching.* Ichthyol water compress. *Crusts—* Soften with wet bandage or cold starch poultice. Wash eau d'Alibour then apply olive oil, etc.	5% hyd. ammon. ointment Colloidal sulphur Ichthyol 2% Sulphur ppt. 10% in ointment or sulphur ppt. in ung. hyd. ammon. or ung. hyd. ox. flav.	Very rebellious Irritation as above Ichthyol water or cocaine ointment Desquamation Ichthyol zinc ointment Hyd. ammon. ointment Hyd. ox. flav. ointment or Sulph. ppt. } 10% of each Ox. zinc Ichthyol in vaseline	Expression. Massage Epilation often necessary Paint Tr. iodi or Tr. iodi } āā Glycerin } aeq or Tr. iodi } āā Acetone } aeq Rebellious cases— $Cu\,SO_4$ } āā 40 ctg. Ichthyol Vaseline } āā 15 gm. Lanoline For use by patient— Ichthyol 0·20 Resorcin 0·30 Lanoline } a^a 5·0 Cold cream after cleaning lids Cuenod—Epilation. Acetone iodine painting Glycerine bandage 24 hours An ointment containing extracts of cultures of staphylococci and other organisms has been recommended. Used alone they appear ineffective

Ulcerating.	Impetiginous.	Sycosic, furunculous.	Associated.
Result mainly from follicular blepharitis	Wet bandages, compresses or poultices to remove crusts, for lids and affected skin	As for ulcerating and follicular blepharitis. In addition, incision of pustules or abscesses, and epilation	Blepharitis associated with conjunctivitis usually recovers with the treatment of the conjunctivitis. In chronic cases treatment with zinc sulphate and with acetate of lead may be adopted, or with nitrate of silver or copper sulphate
Application of a well-pointed silver stick to the ulcers or of 2% $AgNO_3$, or massage with protargol ointment, or of aristol or iodoform	Ichthyol, zinc or hydrarg. am. ointment. Later Lassar's paste	In general precipitated sulphur or resorcin ointment, with use of antiseptic compresses *e.g.* Precipitated sulph. 1 Resorcin 2 Base 20 or Sulph. precipit. 1 Benzoated lard 10 or Resorcin 12 Zinc oxide 25 Talc. 25 Liq. paraffin 100	Lacrymal obstruction should be treated when present
	Cleaning completed by wool moistened with eau d'Alibour	Vaccines or agents for local immunisation	In spasmodic rhinitis, a nasal vaporization of cocaine relieves the condition— Coc. hydrochlor. 5 Adrenalin $\frac{1}{1000}$ 3 Liq. paraff. 100
			In children blepharitis is sometimes associated with enlarged tonsils and adenoids. In such cases these require treatment
			Occasionally lupus vulgaris or syphilis of the nasal mucous membrane is a cause and requires treatment

HUMPHREY NEAME.

III.—OPERATIVE SURGERY

(1) **Bourguet, J. (Paris).—Puncture of the hypophysis by the method of Simons-Hirschmann and by that of the author. (La Ponction hypophysaire, d'après le procédé de Simons-Hirschmann et d'après le notre.)** *Arch. d'Ophtal.*, November, 1929.

(1) The illustrations form so essential a part of this paper that it ought to be read in the original. A brief unillustrated abstract, however, will be of some value to those interested.

Puncture of the hypophysis has been employed to determine the presence or absence of an intra-sellar neoplasm and to establish a diagnosis between this and an extra-sellar tumour.

Simons and Hirschmann (*Nervenarzt*, 1928) advocate and have utilised a pathway through the frontal lobe of the brain, entering the needle through an opening in the frontal bone, close to the left frontal eminence, and endeavouring to impinge on the sphenoid close to the optic tubercle of the same side, from which point it is passed backwards into the cavity of the sella turcica.

Bourguet criticizes this procedure on the grounds that it is difficult, sometimes dangerous, and uncertain. He is strongly in favour of an endo-nasal route to the sella. After dissection of the mucous membrane of the septum and resection of this latter, the blades of a long speculum are used to separate the structures and thus expose the anterior wall of the sphenoidal sinus. This is in turn resected and the cavity of the sinus opened. On the upper wall of the sinus the prominence due to the sella is seen; removal of a piece of the bony wall exposes the dura mater through which the needle can be pushed into the hypophysis. By the action of a syringe attached to the needle a portion of tissue is removed for microscopic examination.

The obvious advantages of Bourguet's procedure are (1) that by the aid of a mirror the needle is visible in the whole of its course, and (2) that the pathway followed is entirely below important structures, and does not traverse cerebral tissue.

J. B. LAWFORD.

(2) **Scarlett, Hunter W. (Philadelphia). — Ptosis operation according to the Shoemaker method.** *Amer. Jl. of Ophthal.*, October, 1928.

(2) **Scarlett's** case was one of ptosis in one eye in which a previous Hess's operation had failed to relieve the condition. The technique was as follows:—The upper lid was everted and superior rectus isolated, a double armed suture being passed through the

middle third of its tendon from within outwards. A horizontal incision was then made from the skin through the entire thickness of the lid at the upper border of the tarsus. The ends of the suture were drawn through this wound, being made to pass through the middle third of the upper portion of the tarsus, the orbicularis muscle and the skin, where they were tied over a small piece of rubber tubing. The knot was tightened according to the amount of correction desired. Over-correction was aimed at at first, and the ultimate result was entirely satisfactory.

F. A. W.-N.

(3) **Majewski, K. W. (Cracow).—Epicorneal syndesmoplasty to permit the use of an epiprosthesis. (Syndesmoplastie épicornéenne à l'usage de l'épiprothèse.)** *Arch. d'Ophtal.*, November, 1928.

(3) The procedure to which the above title has been given by **Majewski,** has been devised and practised by him in cases in which it is possible to utilise an atrophic eyeball as the support for an artificial eye. When the eye, though atrophic, retains a sensitive cornea it cannot tolerate the pressure of an artificial eye. In such cases Majewski covers the cornea with conjunctiva, by dissecting this membrane from the eyeball above and below the cornea and suturing the cut edges together. In his first case the conjunctiva slipped back to its original position when the stitches were removed. In subsequent cases Majewski scraped away the corneal epithelium with a curette and scarified the corneal tissue with a small knife before suturing the conjunctiva. This procedure was successful. The stitches can be removed on the sixth day. The cosmetic result with a suitable prosthesis has proved very satisfactory as is shown by photographs of several patients so treated.

J. B. LAWFORD.

(4) **Eber, Carl T. (St. Louis).—The conjunctival bridge in cataract operations.** *Amer. Jl. of Ophthal.*, February, 1929.

(4) The principal objection to the use of a conjunctival bridge in cataract extraction is the restriction it brings about in gaping of the wound. This results in more lens matter being left behind after expression. **Eber** gets over this difficulty by making his bridge 10-12 mm. long and by passing a pair of forceps under it while expressing the lens, so as to make counter pressure on the scleral lip of the wound. The forceps are of a special pattern illustrated in the text, and bear teeth on the opposed surfaces of their blades, the teeth being used to grasp the lens as it emerges from the wound.

F. A. W.-N.

(5) **Seefelder (Innsbrück). — Denig's mucous membrane in trachomatous pannus. (Zur Denigschen Schleimhautplastik bei Pannus trachomatosus.)** *Klin. Monatsbl. f. Augenheilk.*, Bd. LXXXI, S. 68, 1928.

(5) **Seefelder** reports unsatisfactory results in a case treated by Denig's suggestion of employing a mucous membrane graft in advanced cases of trachoma (*Zentralbl. f. Augenheilk.*, Bd. XXV, S. 278, 1911). In a woman aged 67 years with very severe trachoma with pannus of the right eye, a piece of labial mucous membrane was transplanted following the technique advised by Denig. The graft took well, but very shortly after, it became infiltrated with characteristic trachomatous tissue. The pannus, meantime, continued to progress unchecked. Microscopical examination of the grafted tissue demonstrated without doubt the infection of the new tissue: typical follicles and trachomatous infiltration were present, as also were Prowazek inclusion bodies. Seefelder's observations suggest that the claims made by Denig for the procedure have been stated too highly.

W. S. DUKE-ELDER.

(6) **Elschnig (Prague).—The technique of opening a shallow anterior chamber. (Zur Technik der Vorderkammeröffnung bei seichten Kammer).** *Klin. Monatsbl. f. Augenheilk.*, Bd. LXXX, S. 382, 1928.

(6) The difficulties of opening an anterior chamber without causing outward damage with the usual Graefe knife in cases of glaucoma when it is more than usually shallow have led **Elschnig** to introduce the following technique. It is based on that of Gazet (1884). The superficial parts of the eyeball are anaesthetised (using 1 c.c. of 2 per cent. cocaine hydrochloride with 1 : 10 epinephrine), and a retrobulbar injection of the same substance is made. A conjunctival incision is made 4 to 5 mm. above the limbus extending almost one third of centre of the cornea. The conjunctival incision is made with a scalpel, and the conjunctiva is dissected down to the limbus with scissors, bleeding being stopped with epinephrine. An incision is then made with the scalpel through the limbus into the anterior chamber, the dissection being carried out slowly to check all bleeding with epinephrine. When the anterior chamber is entered the aqueous is allowed to flow out slowly, and then the wound is enlarged to the desired size. The iris is then seized, drawn out, and an iridectomy done in the usual manner, the conjunctiva placed in position, and the eye closed.

The advantages claimed are :—

1. The dissection proceeds in layers and during the process haemostasis can be ensured.
2. The slow evacuation of the anterior chamber avoids intra-

ocular haemorrhage, it also lessens the danger of protrusion of the vitreous through rupture of the zonule.

3. The iris remains entirely uninjured throughout the incision.

4. The lens, therefore, runs no risk of being wounded with the risk of a traumatic cataract. Even if the knife goes too far, it is the zonule, not the lens, which is injured.

5. A total iridectomy, extending up to the root of the iris, is always ensured.

Elschnig recommends the procedure also for an optical iridectomy when the anterior chamber is shallow, or in the extraction of foreign bodies, and in excision of tumours and cysts of the iris.

W. S. DUKE-ELDER.

(7) **O'Brien, C. S. (Iowa City).—Akinesis during cataract extraction.** *Arch. of Ophthal.*, February, 1929.

(7) **O'Brien's** paper opens with a short review of various methods which have been used to secure akinesis of the lids during intra-ocular operations. Injections of the lids have the disadvantage of producing local swelling which makes the operation more difficult, while injection of the trunk of the facial nerve in the region of the stylo-mastoid foramen is a complicated procedure which may result in a prolonged paralysis. The method suggested by O'Brien is remarkably simple and has been used with satisfactory results in more than 200 cases of cataract extraction. It consists in blocking the temporo-facial branch of the seventh nerve. This branch is responsible for supplying the muscles associated with forced closure of the lids and passes over the condyle of the lower jaw. All one has to do, therefore, is to locate the condyle, pass the needle of the syringe down on to it and inject 1 c.c. of a 2 per cent. solution of procaine hydrochloride, injecting another c.c. as the needle is slowly withdrawn. The full effect is evident in five minutes.

F. A. W.-N.

IV.—ORBIT

(1) **Charamis, J. S. (Athens).—A case of hydatid cyst of the orbit. (Un Cas de Kyste hydatique de l'Orbite.)**
Adamantiades, B. (Athens).—Hydatid cyst of the orbit. Perforation of the orbital wall and escape of the cyst through the nostril. (Kyste hydatique de l'Orbite. Perforation de l'Orbite et issue du kyste par lar Narine.) *Arch. d'Ophtal.*, June, 1929.

(1) In a paper published in 1927, on " Hydatid Cysts of the Orbit," Teulières referred to 141 recorded cases; since that date

some 5 or 6 additional examples have been reported. The two cases observed by **Charamis** and **Adamantiades**, one a man aged 50 years, the other a girl aged 11 years, do not present any very unusual features, except that in the latter's patient perforation of the orbital wall occurred and the cyst escaped through the nostril. This occurred after an exploratory operation on the orbit, a provisional diagnosis of tumour having been made. In Charamis's case the cyst was removed through an incision across the upper lid immediately beneath the eyebrow.

In both instances examination of the blood revealed notable eosinophilia. In both cases, also, pain was entirely absent: it has been described by former writers as one of the three cardinal symptoms of this form of orbital disease.

J. B. LAWFORD

(2) **MacCallan, A. F., and Others.—Discussion on the diagnosis and treatment of inflammatory affections of the orbit.** *Trans. Ophthal. Soc. U.K.*, Vol. XLVIII, 1928.

(2) **MacCallan** delivered the introduction to the opening paper of the Annual Congress of the Ophthalmological Society of the United Kingdom on the diagnosis and treatment of inflammatory infections of the orbit. He classified inflammatory affections of the orbit as follows:—

(i) Injuries.
(ii) Primary osteomyelitis.
(iii) Acute dacryo-adenitis.
(iv) Spread of inflammation from neighbouring parts. *e.g.*, panophthalmitis: cavernous sinus thrombosis: infected wounds of the face and eyelids: erysipelas: acute pharyngitis: acute periodontitis: maxillary periostitis: infections of accessory sinuses; tuberculous meningitis: and acute dacryocystitis.
(v) Septicaemic conditions.
(vi) Syphilis. Tuberculosis. Actinomycosis.
(vii) Orbital myiasis. Aspergileosis.

He described six cases of suppuration in the orbit; one case due to a spread of infection from the anterior ethmoidal air cells and the sphenoid, two from the antrum, one following cavernous sinus thrombosis, and one case where adhesions following meningitis obstructed the outflow of lymph from the orbit.

Mr. Norman Patterson said that the majority of cases where orbital inflammation occurred secondary to nasal sinusitis were in children. Birch-Hirschfeld confirms this and states that 59·8 per cent. of the cases are children. Mr. Patterson believes that the antrum and sphenoidal sinus are rarely responsible. The symptoms are headache and nasal obstruction, but pain may be absent.

By the time that the orbit is infected the sinusitis and nose trouble may have cleared up.

Where infection of a nasal sinus is suspected the patient should be examined by transillumination, radiography, and exploratory puncture in the case of the antrum. The urine should be investigated for albumen, sugar, and blood, a leucocyte count done, and a blood culture made in patients suffering from septicaemia and pyaemia.

The complications that may occur are fixation of the globe, cavernous sinus thrombosis, extradural abscess, meningitis, cerebral abscess, and pyaemic abscesses.

The general treatment is rest in bed in an even temperature and to lie on the sound side. A purge is recommended, and aspirin or opiates to relieve the discomfort.

In some cases it is impossible to be certain that pus is present in the orbit. For these patients a waiting policy is advocated. The nose should be treated once a day by steam inhalations of tincture benzoinae co. and menthol, with plugging the nose for 15-30 minutes with cotton wool pledgets soaked in 5-10 per cent. solution of cocaine hydrochloride, and inserted in the region of the middle turbinate bone. This relieves the congestion and assists drainage. The patient must be warned against blowing the nose forcibly. Scarification and amputation of part of the middle turbinate are fraught with some danger during the acute stages and may lead to dissemination of the infection.

The treatment of any underlying nasal cause such as removal of polypi, hypertrophied mucous membrane, opening of diseased sinuses, resection of deflected septum and removal of a septal spur gives relief to the orbital symptoms.

With regard to the orbit, fomentations are good in the early stages, and in older patients many cases will clear up without incision. In children it is advisable not to delay the external incision too long as there is a danger of meningitis occurring.

If the swelling and pain increase the patient must undergo an operation. An incision is made below the inner third of the eyebrow and down to the periosteum. Retractors are inserted and the periosteum incised along the lower border of the supra-orbital margin and then separated from the medial wall of the orbit in a downward and backward direction.

If an abscess is encountered there are often air bubbles in the pus. Haemorrhage is controlled by swabbing and a suction apparatus. The medial wall of the orbit is inspected and any carious or necrotic particles of bone removed. A large opening should be made into the nose. It is advisable to do as little as possible.

In the case of frontal sinusitis with orbital suppuration, the same incision should be employed. The treatment depends on the findings, and it is often best just to incise and drain and leave other treatment till a later date.

Post-operative treatment consists in draining the affected part as long as it is necessary to do so, using nasal sprays, and the avoidance of blowing the nose forcibly, swimming, and diving.

Mr. Patrick Watson-Williams took part in the discussion and gave an account of the orbito-ocular signs which suggested a rhinogenous source of infection. Where infection extended to the orbit from a frontal sinusitis a swelling occurred above the inner canthus, from the ethmoid above and below the medial palpebral ligament, and from the antrum a swelling was present in the lower lid just above the inferior orbital margin. There is chemosis of the conjunctiva on the nasal side. The globe is displaced outward and either upwards or downwards, and there is tenderness and resistance on pressure.

Mr. Watson-Williams spoke of the advantages of endorhinoscopy in detecting latent infection in the ethmoidal and sphenoidal air sinuses. A streak of pus is seen in the vicinity of these sinuses which is often missed by anterior and posterior rhinoscopy.

He advised the examination of the eyes by an expert before operating on the nasal sinuses. Optic atrophy, irido-cyclitis, and retrobulbar neuritis are sometimes present at the time of operation, and unless this has been observed and noted the surgeon is apt to be blamed should the vision deteriorate at a subsequent date.

Mr. Somerville Hastings described a number of cases of inflammatory swelling of the orbit due to syphilis. He related two cases in particular, which resembled mucocele and both cleared up under anti-syphilitic treatment.

Mr. Edward D. D. Davis gave an account of the statistics of 33 patients who suffered from oedema or swelling of the orbital contents and had been sent to him by ophthalmic surgeons for examination of the nose. He emphasised the importance of draining both the orbital collection of pus and the affected sinus.

Where the pus was situated beneath the orbital periosteum great care must be taken not to injure the periosteum. He advocated an intra-nasal operation, and does not use packing or drainage tubes for the orbital incision where such has been made.

Mr. Harrison Butler pointed out the importance of locating the pus accurately. He related a case where there was a collection of pus in the muscle " pyramid," and that after excision of the eye and subsequent drainage the patient recovered. Pus is also found beneath the periosteum of the medial wall of the orbit and in Tenon's capsule.

Mr. Harrison Butler emphasised the necessity for doing a radical operation and advised the co-operation of the ophthalmic surgeon and rhinologist.

Col. A. E. J. Lister gave an account of a girl, aged 14 years, who suffered from a swelling at the outer side of the orbit, of an inflammatory nature, and in which the movements of the eye were little interfered with. The swelling was a suppurating hydatid cyst.

Mr. George Mackay spoke of the importance of blood examination in cases of orbital suppuration. He described two cases where anthrax was the cause of orbital cellulitis.

Mr. A. L. Whitehead emphasised the importance of radiography as a diagnostic agent. Orbital cellulitis in young persons where there was no obvious cause, and not much proptosis, cleared up with rest and fomentations only.

Mr. Jameson Evans described a case of orbital cellulitis following forceps delivery. There was a granulomatous mass on the lid covering the opening of a sinus which passed through the lid and crossed the orbit. At the distal end of the sinus was a sequestrum.

Mr. A. W. Ormond said that the failure of vision in these cases was probably due to interference with the central retinal vessels and pressure on the central artery.

Mr. MacCallan and Mr. Norman Patterson responded and expressed their interest in the opinions that had been given and the accounts of the various cases.

H. B. STALLARD.

BOOK NOTICES

Colour and Colour Theories. By CHRISTINE LADD-FRANKLIN, Ph.D., Lecturer in Columbia University, New York. Pp. 287. New York: Harcourt, Brace & Co. London: Kegan, Paul, Trench, Trubner & Co. 1929.

Mrs. Ladd-Franklin has been a frequent writer and an ardent fighter about colour vision. The present volume will be welcomed by those interested in the subject; and the more so because it is not a new work, but a collection of all her previous communications. No one can read the earlier papers without recognizing that Mrs. Ladd-Franklin was a pioneer who did first class original work. One has only to remember that she was the first to lay stress upon the night-blindness of the fovea—a fact already well known empirically to astronomers; and that she made the very important discovery, soon confirmed by Ebbinghaus, that the complementary whites formed by red and blue-green and yellow and blue respectively, if of equal brightness to the light adapted

eye, did not retain equality of brightness if the physical intensities were considerably reduced. Her papers of 1892 and 1893 will especially repay perusal even at the present time; and her strictures on both the Young-Helmholtz and the Hering theories are no cantankerous beatings about the bush, but solid arguments demanding consideration and reply by the adherents of those theories. That some of the arguments have been adequately refuted in the light of greater knowledge is probably in no small degree due to their apparent potency at the time they were published.

As is well known Mrs. Ladd-Franklin was led to propound a photo-chemical theory of colour vision. This genetic theory has much to commend it, but like most theories of colour vision is speculative and fails in the most important function of a working hypothesis, that of pointing out fruitful lines of future research. *Per contra*, it has had the usual effect of giving rise to reams of philosophical speculation which lead nowhere, and one of its worst crimes is that it has diverted its distinguished author from fruitful research to fruitless polemics. It is for this reason chiefly that we welcome this volume of reprints rather than a new exposition of the subject, for in our opinion Mrs. Ladd-Franklin's early papers are much more valuable than her later ones. In no subject is the real solid work of pioneers more likely to be snowed under by useless controversies than in colour vision. This volume will throw Mrs. Ladd-Franklin's valuable contributions into proper perspective—a fitting monument to a veteran.

Le Daltonisme. By PAUL BLUM and E. SCAFF, with a preface by PROF. DE LAPERSONNE. Pp. 131. Paris: Masson et Cie. Price, 20 francs.

The full title of this brochure is "Daltonism: its practical importance, clinical forms, and diagnosis." It is therefore essentially a practical work, and is written by the principal medical officer and the oculist to the railways of Alsace and Lorraine. There is a very brief historical sketch of colour-blindness, and equally brief—and unsatisfactory—remarks on the Young-Helmholtz and Hering theories. In discussing the practical importance of colour-blindness due credit is given to Wilson, and stress is laid upon the small visual angle subtended by signal lights, and the fact that in America, and recently in England, signal lights are being used by day as well as by night. The classification of colour-blinds follows the usual trichromatic version, but is somewhat unnecessarily elaborated. The authors' statistics give 3-4 per cent. of "absolute daltonians" and 8 per cent. of "relative daltonians." The most valuable part of the work consists in a description of the methods of testing railway employees. All the usual methods are described, with some critical remarks; but methods involving

the use of spectral colours—which must ever be the court of final appeal—receive scant attention. There is an interesting short chapter on tests carried out on a stretch of railway line one kilometre long, with special signal lanterns, telephonic communications, etc. There is a somewhat incomplete bibliography.

The Transactions of the Ophthalmological Society of the United Kingdom. Vol. XLIX. 1929.

The Transactions of the Ophthalmological Society of the United Kingdom for the session 1929 are now published. The book is arranged in the manner of previous volumes, and contains reports of the discussions and papers read to the Society at the Annual Congress, and also accounts of the transactions of the Oxford Congress, the Midland, the North of England, and the Irish Ophthalmological Societies.

At the Annual Congress, the discussions concerned heterophoria, and the diagnosis and treatment of ocular tuberculosis; while the papers on " Formative fibrous tissue reaction in the eye," by E. Treacher Collins; on " The structure and properties of the vitreous body," by W. S. Duke-Elder; on " Graded squint operations," by F. A. Williamson-Noble; and on the " Prevention of minor eye injuries in industry," by Bernard Cridland, are of particular interest.

At the Oxford Ophthalmological Congress Professor Joseph Meller (Vienna) read the opening paper on " Diseases of the lacrymal apparatus." There is a full account of the Doyne Memorial Lecture on " Some observations on the vascularization of the vertebrate eye," by Ida Mann; and also an interesting account of the papers read by Hugh Cairns and Charles Goulden on the " Ocular manifestations of head injuries."

The remainder of the book contains the reports of the papers, cases, and specimens at the meetings of the Midland, North of England, and Irish Ophthalmological Societies.

We hope to publish summaries of the more important papers in the abstract section of this journal at a later date.

Stereoskopischer Atlas der äussern Erkrankungen des Auges. By KARL WESSELY (München). A first instalment of ten stereo-photographs ($2\frac{1}{2}$ in. × 2 in. on cards 7 in. × 4 in.) München: J. F. Bergmann. Price, R.M. 12.00.

The advantages of stereoscopic photography in ophthalmology are sufficiently obvious not to need emphasis. But, for technical reasons the production of coloured stereo-photographs presented such great difficulties that all available photographs have been made devoid of natural colouration, being merely black and white. The question of colouration was discussed at the Heidelberg Ophthalmological Congress in 1927, when Professor Wessely

and his collaborator, Dr. Zabel, showed how to overcome the difficulties involved, and the present series of ten highly successful coloured stereo-photographs shows that the production of such pictures has passed from the experimental stage to an established procedure. There can be no doubt that the publication of these photographs opens a new field in the illustration of eye diseases.

The principles employed in the making of these photographs are not explained in the four-page pamphlet (in German) accompanying the pictures. The author refers to the transactions of the Congress mentioned, from which it appears that the camera used is one specially constructed according to the design of Professor Wessely, and that the photographs are taken by an ordinary nitra light. But in a footnote in the present pamphlet a statement is made that some of the pictures were taken by " a small Stereo-Palmos Icacamera by the use of flashlight."

The appearance of the present collection almost immediately after the excellent series of uncoloured photographs by von Rötth (reviewed in the February number of this journal) shows that considerable attention is being given to stereo-photography in Central Europe.

CORRESPONDENCE

IMPROVEMENT OF VISUAL ACUITY OF CATARACTOUS EYES

To the Editor of THE BRITISH JOURNAL OF OPHTHALMOLOGY.

DEAR SIR,—In view of reference in this Journal in recent years to visual changes in cataract cases with or without medicinal treatment, it seemed that it might be of interest to report the following case:—

Miss H.E., aged 56 years, was seen in May, 1927. V.R. 6/18 (2 letters); V.L. 6/36. By retinoscopy and without a mydriatic, some hypermetropia and 0·25 D. astigmatism was found in the right and 0.5 D. astigmatism in the left eye.

$$\text{R.}\ \frac{+\ 1{\cdot}5\ \text{D.sph.}}{+\ 0{\cdot}25\ \text{D.cyl.}\ 90^\circ} = 6/9. \qquad \text{L.}\ \frac{+\ 1{\cdot}0\ \text{D.sph.}}{+\ 0{\cdot}50\ \text{D.cyl.}\ 120^\circ} = 6/18.$$

In March, 1929, retinoscopy revealed more hypermetropic astigmatism in the right and very slightly more in the left eye.

R. + 0·75 D.cyl. 90° = 6/9. L. + 0·75 D.cyl. 120° = 6/9.

It will be seen, therefore, that in both eyes the hypermetropia had disappeared, leaving only hypermetropic astigmatism. The vision of the left eye with a cylindrical change of only 0·25 D. had improved from 6/18 with a lens in 1927 to 6/9. It should be noted

that, with the lens of 1927, the left vision was, in 1929, as much as 6/12. Further remark or comment seems unnecessary.

Yours faithfully,

HUMPHREY NEAME.

LONDON,
February, 1930.

GLAUCOMA RESEARCH

To the Editor of THE BRITISH JOURNAL OF OPHTHALMOLOGY.

SIR,—It is not too soon to suggest that a discussion on glaucoma be made a main item on the programme of the next International Congress and that the International Council appoint a sub-committee to deal with the matter, with objects somewhat as follows.

1. To arrange that systematic study of different specific aspects of the subject be taken up in some half-dozen or more of the larger clinical centres and laboratories.

2. To act as a co-ordinating centre, receive interim reports and issue bulletins to the workers, so that results as they are obtained may be available to all who are actively investigating.

3. To receive all final reports, some six months before the date set for the Congress and to co-ordinate them into a general report.

So many practical suggestions, requiring investigation, have been made, that if an adequate system were organized, a large amount of information would be available, possibly even the problems of cause and treatment solved. The mere task of organization will be no light one as so many details need investigating.

What for instance is known of the type of glaucoma in which the nerve-head seems to melt away, although there is practically no uveitis nor hypertension? To me it always recalls a sarcomatous knee-joint which was exhibited at the British Medical Association meeting in 1923 at Portsmouth. This large specimen, some ten inches across, had been bisected and half of it mounted in the usual way. The other half had been submitted to the action of a broth containing bacillus subtilis and a staphylococcus. It looked as though it had been left out in the field, to the action of beetles, larvae and micro-organisms. The bone had been picked clean, within and without, there was not a vestige of soft tissue left and the various concentric layers of pathological bone stood out stark and naked and this was largely due to a staphylococcus. It may seem fanciful to think that there is any connection in the disappearance of tissue in these two instances, but there is reason to think that a staphylococcus was active in both. In 1925 I reported a few cases in which a staphylococcus was found within the eye-ball

under conditions which seemed to exclude contamination. I did this in the hope of arousing interest in this aspect of the question. Apparently, though, operators still continue to reject material removed from glaucomatous eyes as useless. Since then we have had one comprehensive report on glaucoma, from Moorfields. Unfortunately this report deals almost exclusively with disorganized eyes, while what we need is information as to the prodromal stage, when there is no ordinary sign of disease present, although the impracticable fluorescine test would probably be positive. The beautiful methods used by Kölliker of noting the changes in cellular outline, shown by examination with X-rays and ultra-violet rays do not seem to have been developed and should be fully investigated.

Even if the constant presence of a specific infection in glaucoma be proved, one has to look further for the ultimate cause, as germs, except when very virulent, do not establish themselves in healthy tissue. In London in 1925, Hawley of Chicago reported five cases of glaucoma, cured by correction of intestinal toxaemia, which he claimed as the cause of the disease. To some extent the point is well taken, but other sources of toxic absorption cannot be ignored and it must be borne in mind that an insufficient dose of purgative given to a patient with a torpid bowel is a potent cause of toxic absorption and can do great harm instead of good.

Since the publication of Fischer's book on oedema, a number of attempts have been made to reduce tension by saline injections; it is perhaps unfortunate that the kation sodium was chosen for this purpose as it causes retention of fluid in the tissues and any benefit will be but temporary. Calcium and potassium cause removal of fluid from the system and should be more efficacious.

Iodized oil also promotes prompt removal of fluid from the eye and as, in addition, it causes absorption of exudate and dead cells and has a powerful anti-toxic action its effects should be systematically investigated. I have treated a few cases of glaucoma with good results with iodine alone and have never used it in any case of the inflammatory type without great benefit.

There seems to be little doubt but that hypertension is due to swelling of the ciliary body. Whether this is sufficient in all cases to raise tension or whether inflammatory fluid secreted by the ciliary cells, posterior to the suspensory ligament, is retained, owing to insufficiency of the ligament, is also a matter of doubt.

These are but a few of the many points upon which information is required and can be obtained. With adequate organization results are certain, without it fortuitous.

Yours faithfully,

RICHARD KERRY.

MONTREAL,
December 20, 1929.

NOTES

Death

WE regret to record the death of Professor Kuffler, of Berlin, editor of the *Zentralblatt f. die gesamte Ophthalmologie.* He was 54 years of age.

* * * *

British Medical Association

THE 98th annual meeting of the British Medical Association will be held at Winnipeg, from August 26 to August 29, 1930. The President will be W. Harvey Smith, M.D., Professor of Ophthalmology, Manitoba Medical College, and ophthalmic surgeon, Winnipeg General Hospital. The officers of the ophthalmic section are as follows:—President, N. Bishop Harman (London); vice-presidents, A. J. Ballantyne (Glasgow), Norman Fleming (London), Professor T. H. Bell (Winnipeg) and Glen Campbell (Vancouver); hon. secretaries, G. H. Whiteside Robertson, O.B.E. (Guernsey) and F. D. McKenty (Winnipeg).

* * * *

International Congress in Spain

THE National Committee for the International Congress in Spain in 1933 are: *President,* Marquez; *Vice-Presidents,* Castresana, Senr. and Mansilla; *Secretary,* Poyales; *Treasurer,* Castresana, Junr.

FUTURE ARRANGEMENTS

1930

March 7.—North of England Ophthalmological Society, at Liverpool.

March 14.—Section of Ophthalmology, Royal Society of Medicine, (Clinical Meeting.)

March 28.—North of England Ophthalmological Society, at Sheffield.

April 1.—Midland Ophthalmological Society, at Wolverhampton.

April 2-5.—Ophthalmological Society of the United Kingdom, Annual Congress. Thursday, April 3.—*Morning.*—Presidential Address. Presentation of Nettleship Medal. *Afternoon.*—Papers. Discussion. *Evening.*—Reception at Royal College of Surgeons, 9—12.
Friday, April 4.—*Morning.*—Papers. *Afternoon.*—Papers. 5 p.m.—Bowman Lecture. Sir Arthur Keith. Subject: "The Genius of Sir William Bowman." *Evening.*—7.30 for 8, Banquet at Fishmongers' Hall, London Bridge.
Saturday, April 5.—*Morning.*—Papers. Business Meeting. *Afternoon.*—Visit to Zoological Gardens, tea in the Fellows' Tea Rooms at 4.15.

June 3.—Midland Ophthalmological Society, at Worcester.

June 13.—Section of Ophthalmology, Royal Society of Medicine. (Annual Meeting.)

July 10-12.—Oxford Ophthalmological Congress, at Oxford.

August 26-29.—British Medical Association, at Winnipeg.

October 7.—Midland Ophthalmological Society, at Birmingham.

December 2.—Midland Ophthalmological Society, at Birmingham.

CONTEMPORARY OPHTHALMIC LITERATURE

American Journal of Ophthalmology. *January, 1930.*

PILLAT. Tapetoretinal degeneration of the central fundus region.
LILLIE. Homonymous hemianopia: primary sign of tumours involving lateral part of the transverse fissure.
POST. Subconjunctival iridectomy for glaucoma.
COWAN. Accessory effects of the correcting glass by its position before the ametropic eye.
DAVIDSON, ELLETT and POST. Impressions of the Amsterdam Congress.
CROSS. Removal of lead shot from the vitreous.
WILDE. Gaseous erosion of the cornea.

Archives of Ophthalmology. *December, 1929.*

CLAPP. Crystalline deposits in the vitreous: report of two cases of calcium soap, studied microscopically and histochemically.
VERHOEFF. Retinoblastoma: report of a case in a man aged forty-eight.
GIFFORD. Muscle transplantation for paralytic strabismus.
KNAPP. Keratoconus: etiology and treatment.
KIRBY. Keratitis exfoliativa complicating dermatitis exfoliativa (arsphenamine).
GOUTERMAN. The rôle of calcium in essential glaucoma.
RODIN. Angioma of the iris: first case to be reported with histologic examination.
WRIGHT, R. E. Akinesia during extraction of cataract
RUCKER. Regeneration of the cornea.
CROLL. Aniridia occurring in three generations.
JUDGE, MOTT and GABRIELS. Ankyloblepharon filiforme adnatum.

Archives d'Ophtalmologie. *December, 1929.*

COPPEZ. The mechanism of lesions of the chiasma in fractures of the skull.
WEEKERS. The psycho-physiological aptitude of motor drivers.
CANGE. On the subject of "white grains in keratitis and leprous iritis."
PESME. Two cases of Crouzon's cranio-facial dysostosis.

Klinische Monatsblätter für Augenheilkunde.

Jauuary, 1930.

VOGT. New cases of lens capsule glaucoma.
BARTELS. On voluntary nystagmus and on the conditions under which an organic nystagmus can be again voluntarily produced.
RÖSSLER. The estimation of the refraction of the eye with the help of the cobalt lamp.
FUCHS, A. On albuminuric choroiditis.
SALZER. On a previously unknown congenital anomaly of the human lens. (Lens without nucleus.)
TICHO. On the trachoma question in Palestine.
LÖWENSTEIN. On the course of the pathological appearances in intra-ocular tumours.
NOJI. Unusual persistent pupillary membrane.
ALEXANDER. Removal of persistent pain in absolute glaucoma and ciliary neuralgia after anaesthetization of the Gasserian ganglion.
MEYER. The use of luminal to facilitate eye operations in children.
LIEBERMANN. On the indications for orbital anaesthesia, with observations on a new method of anaesthesia.
LUZSA. X-ray treatment for blepharitis.
FISCHER. On a new universal slit-lamp.
LÖWENSTEIN, Lip-clamp for plastic operations on the mucous membrane of the mouth.
LIEBERMANN. A new method of keeping eye drops.
KRAUTBAUER. Supplementary observations on platino-chloride tattooing.
GEISLER. On the radiographic localization of intra-orbital bodies.
GUTZEIT. A new set of bone instruments for Toti's operation.

Zeitschrift für Augenheilkunde. *January, 1930.*

JUNIUS. Appearance and course of juvenile retinitis exudativa macularis.
SCHMELZER. On the meaning of erythyrocyte sedimentation time in ophthalmology.
SCHUSTER. On a case of so-called pigment spindle of the cornea.
GRAF and REIS. Observations on the histopathology of intra-dural vascular tumours of the optic nerve (haemangioma sarcomatosum).
ZÁHOR. On the disappearance of copper in the eye.

Annali di Ottalmologia e Clinica Oculistica.

October-December, 1929.

OVIO. The ancient and modern concepts of ophthalmology.
MAGGIORE. Trachoma in Italy.
LODDONI. The zonule of Zinn.
TESSIER. The normal intra-ocular tension in accommodation and convergence.
FIORE. The radical cure of glaucoma with cautery sclero-ciliarotomy (Fiore).
PANICO. Encapsulated retro-bulbar angio-fibroma.
SABA. Acquired heterochromia in a case of resection of the trigeminal.
DI GIUNTA. Trachoma in Cyrene during recent years.
SCOTTI. On various methods of measuring the pupil.
BAER. Contribution to the question of tattooing with chloride of gold.

Archivos de Oftalmologia Hispano-Americanos.

January, 1930.

GUIRAL and GUIRAL. Treatment of sympathetic ophthalmitis by an auto-serum.
GÓMEZ-MÁRQUEZ. Typical and atypical ocular tuberculosis.

Boletin de Información Oftalmológica. *May-June, 1929.*

ONETO and DAMEL. Tumour of the optic nerve.
DAMEL and GALLINO. Retinitis punctata albescens.